VOL. 2. NO. 7.

THE
Sidereal Messenger.

Conducted by Wm. W. PAYNE,
Director of Carleton College Observatory.

OCTOBER, 1883.

CONTENTS:

"To impress upon the mind the reality of the peafection of the works of the omnipotent, the living GOD."—Professor JAMES C. WATSON.

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The Sidereal Messenger.

Conducted by WM. W. PAYNE, Director of Carleton College Observatory.

"In the present small treatise I set forth some matters of interest to all observers of natural phenomena to look at and consider."—GALILEO, *Sidereus Nuncius*, 1610.

VOL. 2. NO. 7. OCTOBER, 1883. WHOLE NO. 17.

Memorial Address in honor of FREIDRICH WILHELM AUGUST ARGELANDER,

Doctor of Philosophy. Professor of Astronomy in the Royal Frederick William University in Bonn and Director of the observatory in that city, Privy counsellor, Knight of the Imperial St. Anne's order (second class), of the Royal Prussian order of the Red Eagle (second class with the star), and of the Royal Swedish North Star order, Commander of Grand-ducal Zahringer Lion order and Knight of the Royal Prussian order *pour le merits*, Honorary member of the Finish Scientific society, Member of many foreign scientific societies, etc.

Delivered at the Anniversary and Festival of the Scientific society of Finland April 29, 1875, by A. KRUEGER.

[Translated from the Swedish and arranged for publication by the Smithsonian institution by Professors R. B. ANDERSON and EDWARD S. HOLDEN of the University of Wisconsin.]

NOTE BY THE TRANSLATORS:

As this biographical sketch relates especially to the period of ARGELANDER's residence in Finland, and as that period of his life is the least known, we have thought that a translation from the original Swedish would be welcome.

Ladies and Gentlemen:

About ten weeks ago a message of sorrow sped with lightning velocity over the civilized world. The last veteran of modern astronomy, Argelander, had closed on the 17th of February, his long life which had borne so much fruit for our knowledge of the stars. Not alone in Germany, where the deceased had spent the greater part of his life, but also in other lands, the news of his death was received with sorrow and regret. Scarcely one could be found

among the numerous astronomers both in the old and in the new world, who had enjoyed more or less intimate scientific association with him, who did not realize that he had lost in him, a faithful friend and a counsellor always willing to give aid. Among us, Argelander's death has been a source of special grief. At the Abo Academy and at the Helsingfors University he laid the foundations of his fame. By the work he did here the observatory of the Finish University was introduced so to speak to the scientific world. When, after a service of more than thirteen years he left Finland, he had gained a respected position not only as a scientist, but also as a citizen; and the vacancy he left it has never since been possible perfectly to fill. The Finish Scientific Society, which was organized two years after his departure from Finland, has during a long series of years counted him among the number of its honorary members in foreign lands in order to express in some way its high regard for his scientific merits. In accordance with the time-honored custom of the society honoring at its anniversary meeting the memory of its deceased members I have been requested to deliver before this honorable body a brief sketch of Argelander's life. The duty thus imposed on me has in one respect been painful in as much as it has opened afresh the wounds of sorrow at his loss which affected me personally, but in another respect it has been a pleasant duty for me, who for twenty-two years have enjoyed the advantage of having been the pupil, co-laborer and friend of the deceased, to find an opportunity of publicly expressing the esteem and love which I, like so many others who were closely associated with him, cherish for his immortal memory.

It would be impossible to give to-day even an approximately complete account of Argelander's eventful life. Such an account would require much study and preparation and the delivery of it would under any circumstances require far more time than I am able to claim from my distinguished audience to-day. What I am now able to present is a mere sketch, which particularly treats of the earlier period of Argelander's life ending with his departure

from Finland. I have reason to believe that a more complete account of his whole career will appear before very long.

Fredrick Wilhelm August Argelander was born on Good Friday the 22nd of March 1799, in Memel in East Prussia. His father, Johann Gottfried, who was a wholesale merchant and ship-owner was on his father's side of Finish descent. Branches of the family still live in various parts of Finland, where they are called Argillander. The late district judge in Kuopio, August Forsten, while collecting materials for a history of the settlement of North Sacolax discovered various special notices of this family, which from Sacolax appears to have spread over all Finland and into foreign lands, but so far as I have been able to learn no definite clue was found to the genealogy of our Argelander. Meanwhile it may be regarded as certain, that his grandfather, who was born in Perua in 1726, lived as a coppersmith in Lovisa. Of him, or of his father, there is a tradition occasionally referred to by Argelander himself to the effect that he placed the weather-vane on the Abo cathedral. He afterwards removed to Tilsit in East Prussia and his son Johann Gottfried the father of our Argelander became a merchant and settled in Memel.

The childhood of the young Argelander was contemporaneous with the epoch so unfortunate for Prussia, when the royal family, after the battle of Jena and the terrible misfortunes which subsequently happened, was forced to retire to Memel the most remote city of the monarchy. There was a lack of houses in the little town, which could give suitable accommodations to even so unpretending a court. Argelander's father then placed the upper story of his house at the disposition of the royal family and the crown prince, Prince Fredrick, and their stewards moved into it. Thus it came to pass that the young Argelander became the playmate of the young princes and their youthful companionship grew in course of time into a warm friendship which the crown prince, afterwards King Fredrick Wilhelm IV especially, and Prince Wilhelm, now Emperor Wilhelm cherished for Argelander, and, which Arge-

lander returned with genuine devotion even to his dying day.

After having received elementary instruction at home, Argelander attended the gymnasium and the new famous collegium Fredericanum in Konigsberg (1813-1817) and after passing his preliminary examination he was admitted as student in the Konigsberg university, April 2, 1817. His intention was to study the science of finance and to seek appointments and advancement in the government finance department. But his attendance upon Bessel's lectures soon led his mind in another direction. Bessel's attention was drawn to the remarkable talents and industry of the young man. He tested his ability by entrusting to him some difficult calculations and thereupon unhesitatingly persuaded him to devote himself exclusively to astronomy. Nor was any great urging on Bessel's part necessary, for Argelander was very willing to give up his study of finance and follow his bent for astronomy. It is also a remarkable fact, that Bessel, Wilhelm Struve and Argelander, who for a long time independently but in the same spirit labored to develop our knowledge of the stars, from the beginning had marked out other careers for themselves than those which they afterwards adopted. Bessel remained until half of his course at the gymnasium was completed, a clerk in a commercial house in Bremen. He soon made up his mind to secure a more independent position as ship-chandler and for this purpose he thought it would be of advantage to him to secure an elementary knowledge of nautical astronomy. Thus an entirely new world was opened to him and by the kindness of Olbers he was afterwards enabled to devote his talents to science. Wilhelm Struve began his scientific career as a linguist, and although he in a short time developed into Russia's most eminent astronomer, he always retained a peculiar predeliction for classical studies and classical languages. These men show how great talents when united with untiring industry always succeed in finding their right sphere of usefulness.

As early as the 1st of October, 1820 Argelander was accepted as assistant at the Konigsberg observatory and while

he held this position he devoted all his energy partly to the routine observations of the observatory and partly to independent researches. Bessel was a severe teacher; he demanded much from himself and he required his pupils to be like him. How industriously he labored at this time in Konigsberg can only be appreciated by the specialist who examines the observations published by Bessel together with the introductions written for them and the articles published in astronomical periodicals. Still it would be incorrect to represent Argelander as sinking under the burden of labor. On the contrary, he was a happy student, took part in the amusements of his comrades and was a welcome guest at merry-making and at family gatherings. He had a rare faculty of combining the earnestness of the scientist with the good humor of the gentleman of society. He was fond of good society and contributed much to its enlivenment by his great conversational powers. Thus he was beloved by all his companions from this time and as an accomplished gentleman he still lives in the memory of the few of his Finnish friends who are yet living.

During the period of a year and a half following his appointment as assistant at the observatory, Argelander had been able to complete his university studies in addition to attending to the routine duties of the observatory. After passing his examination for the degree of doctor of philosophy and publishing and defending a thesis written for the occasion "*de observationibus a Flamsteedio institutis*" he was made doctor of philosophy on the 1st of April, 1822. It did not then occur to him that 50 years later his friends both at home and abroad would celebrate this day with such an overwhelming number of congratulations and resolutions in his honor, among which the greeting sent him by the university of Finland would be one of the chief sources of joy at the festival.

Soon after taking the doctor's degree Argelander published another work: "*Untersuchungen uber die Bahn des grossen Cometen vom Jahre 1811.*" This is a model treatise on this remarkable comet, which even to this day is remembered by old persons. On account of this performance

and after passing a colloquium before the philosophical faculty he was the same year appointed privatim-doceus at the university, a position which, as is known, is without emoluments at the German universities but which still from a scientific standpoint co-ordinates the incumbent with the regular professors, in as much as a privat-docent can at any time be called to fill a professor's chair without any further examination into his qualifications.

I now came to a new epoch in Argelander's life; to his removal to Abo. How the new observatory there was at length established by the zealous efforts of the friends of the academy and especially of Hallstrom, who conquered all obstacles, we have been told in an academy program written by Prof. A. Moberg in 1862. H. J. Walbeck was the first astronomer to whose direction Urania's new temple on the observatory hill was constructed. He had become known in a most favorable manner by an essay "*de forma et magnitudine telluris*," which is the first rational attempt to combine the various measurements made before that time into one result. Walbeck visited Konigsberg* in the winter of 1820-1821, and took part under the direction of Bessel in the work of the observatory and doubtless became on this occasion intimate with Bessel and Argelander. After his unfortunate decease the 23d of October, 1822, the directorship of the observatory of the academy was vacant. No competent candidate was found at home and so Argelander resolved, not without, as I suppose, consulting Bessel, to apply for the position. At the meeting of the Consistorium Academicum April 6, 1823, his application was read by the Rektor, which was followed, as the records for that day show "by a fine testimonial dated March 19 and written for him by the famous professor of astronomy and knight Bessel, according to which testimonial Argelander had for nearly two years been assistant at the Konigsberg astronomical observatory, was in possession of the necessary theoretical knowledge and also had had the experience in the practical use of astronomical instruments necessary to fill the position he was now seeking."

"In reference to this application, Prof. Fattenborg, in

*Koenigsberg Beob. Abt. 8.; Obser. Dorpatenses, vol. IV, p. XLVII.

behalf of the philosophical faculty, stated, as the result of the faculty's deliberations, that Doctor Argelander had been found fully competent for the position he was seeking, and as the Consistorium was perfectly unanimous in this matter, his name should be sent to his Imperial Highness, the High Chancellor of the university, that he might obtain his credentials as director of the astronomical observatory, and with his uame should be sent his application together with the accompanying documents." The appointment was made by April 28, and Argelander having just before that married his still surviving wife, Maria Sophia Charlotte Courtan, he very soon set out upon his journey to his new home. In July 1823, he spent nine days with Prof. W. Struve in Dorpat, who then ranked high among the astronomers, and with him he entered into a bond of friendship which kept these two men intimately united as long as they lived.

The days spent in Dorpat* were devoted to investigations in regard to the so-called personal equation (just then observed by Bessel) or the difference existing between different observers in the time given for their astronomical observations. The 12th of August 1823, Argelander landed with his wife in Abo, and on the twenty-first of the same month he was requested to appear in the Consistorium Academicum to take the oath of office.

At the time when he entered upon his duties as director, the observatory was already in a respectable condition. Men full of scientific zeal and first among them Hallstrom, had applied their insight and their influence toward getting the new building constructed in a manner adequate to its purpose and in harmony with the demands of the age, which in many respects differed from those of earlier days. Liberal appropriations had been made on the reccommendation of the consistorium by the High Chancellor of the academy for the purchase of such instruments as seemed especially desirable, and in February 1824, Argelander was able to begin a long series of observations which were made

*Koenigsberg Beob, 6 Abt p. III; 8 Abt. p. IV. Briefwechsel Zwischen Olbers u. Bessel 2 Theil, p. 185.

with the vertical circle manufactured by Liebhen. In the introductian to the first volume of his "*Observatioues Astronomical in Specula universitatis litterariae Fennical factae*" is given a catalogue of the instruments which were found on his arrival and of those which afterwards in the course of the following years were procured from abroad. Among these we find among others a large Transit instrument by Reichenback, the same that I use in my zone observations, also the above mentioned vertical circle, a large refractor which was first put up in Helsingfors, and above all a meridian circle by Reichenback & Ertel of the same construction as those procured by Bessel and Struve and with which Argelander was to win his first laurels as a practical astronomer. As soon as this excellent instrument was put in order, he began a series of observations of 560 fixed stars with more or less proper-motion. The results of these observations, which were made during the time from February 1827 to May 1831 are found in the catalogue of stars known as the Catalogue Aboesis which holds the first rank among this kind of work of its time and which was rewarded in 1831 by the Imperial Scientific Society of St. Petersburg with the great Demidoff prize. On the basis of the proper-motions calculated in this catalogue Argelander was afterwards able to make the first accurate calculation of the proper motion of our solar system in the universe.

(*To be Continued.*)

ON THE REDUCTION OF DIFFERENT STAR CATALOGUES TO A COMMON SYSTEM.

BY WILLIAM A. ROGERS.

[*Concluded from page 169.*]

In the paper on "A Comparison of the Harvard College Observatory Catalogue of Stars for 1875.0 with the Fundamental Systems of Auwers, Safford, Boss, and Newcomb," the method here described has been essentially followed. But in order to reduce the magnitude of the residuals with which we have to deal, the computed corrections depending

on both the right ascension and the declination were subtracted from the original residuals and the values of $d\Delta\alpha$ and $d\Delta\delta$ which remain were treated in the way above described, giving the corrections found in Table III. Notwithstanding the criticism of Prof. Safford that this method is unusual, I must maintain that it gives nearer approximations to the true corrections than can be obtained in any other way.

Professor Safford has given an exhaustive discussion of the most probable values of the right ascensions of a list of stars given in the Memoir to which reference has been made. This discussion involves, however, a knowledge of the systematic errors of the catalogues compared. It will be interesting to compare with his results the final results of the Harvard College observations of these stars, in which there is a direct dependence upon the system of Publication XIV., and in which, therefore, there is no need of applying corrections for a systematic deviation from the assumed system. An experience of thirteen years has shown that the Harvard College Meridian Circle can be relied upon to follow very closely the fundamental system chosen in a series of differential observations.

Two stars of the list have erroneous values in the final catalogue.

For β Lyræ, the right ascension should read $18^h\ 45^m\ 27^s.851$, instead of $27^s.774$.

In the case of υ Pegasi, there is a misprint in the volume for 1872 of $23^h\ 18^m\ 59^s.374$ for $59^s.574$.

By a reference to the original manuscripts it is found that both of these errors had been corrected, but by some mistake the corrections were not made on the sheets prepared for the printer. There were about a dozen errors of this kind, but all of them seem to have been corrected in printing except these two.

For the remaining stars the deviations from the positions given in Publication XIV, are given below, except for the star 1 H. Draconis, where the comparison is made with the place derived from the correction given by Auwers in A. G. 1879, p. 2. These results are given in advance of pub-

lication, with the permission of Professor Pickering, the Director of the Observatory.

Year of Obs.	H. C. O. *minus* Pub. XIV.
Br. 6. $\alpha = 0^h\ 9^m$ $\delta = +76°.3$	
	s.
1871	−.04
"	+.00
"	+.11
"	+.18
1872	+.05
"	+.11
"	+.07
"	+.11
1873	+.11
"	+.19
"	+.12
"	+.11
"	+.33
"	+.14
"	+.30
"	−.05
1874	+.11
"	+.00
"	+ 14
"	+.17
"	+.41
1875	+.49
"	+.31
1876	+.02
"	−.11
"	+.09
"	+.26
1877	+.12
"	+.05
"	+.19
"	+.51
"	+.47
"	+.42
"	+.29
"	+.14
η Cassiop. $\alpha = 0^h\ 42^m$ $\delta = +57°.2$	
	s.
1870	+.01
"	+.03
"	−.02
	s.
1871	+.06
"	−.01
"	+ 02
"	+.18
"	+.07
"	+.05
1872	+.03
"	+.12
"	+.11
1873	+.18
"	+.13
"	+.13
"	+.14
"	+.12
1874	+.03
"	+.11
"	+.02
"	+.10
"	+.15
"	+.01
"	−.03
"	+.08
1876	+.05
"	+.07
"	+.08
"	+.08
1877	+.09
"	+.12
"	+.17
"	−.01
"	+.04
"	+.17
"	+.03
36 Camelop. $\alpha = 6^h\ 0^m$ $\delta = +65°.7$	
	s.
1871	+.17
"	+.08
"	−.03
1874	+.05
"	+.01
	s.
1876	+.07
"	+.10
"	+.15
"	+.00
1 H. Draconis. $\alpha = 9^h\ 19^m$ $\delta = +81°.9$	
	s.
1871 U.C.	+.25
"	+.17
1871 L.C.	+.07
"	+.14
"	+.18
"	+.01
"	−.06
"	+.12
"	+.19
"	+.19
"	+.15
"	+.00
"	+.04
"	+.03
1872 U.C	+.14
"	−.09
"	+.26
"	−.02
"	+.19
"	+.52
"	+.23
"	−.11
"	+.17
1873 U.C.	+.25
1873 L.C.	+.15
"	+.28
"	−.01
"	+.33
"	+.34
"	+.35
1874 L.C.	+.25
"	+.34
"	+.42
"	+.49
1875 U.C.	+.38
"	+.28
	s.
1875 U.C.	+.19
"	+.22
"	+.31
"	+.52
"	[+.80]
"	+.18
1876 U.C.	+.55
"	+.06
"	+.01
1877 U.C.	+.69
"	−.26
"	+.35
"	+.11
"	+.28
1878 U.C.	+.12
"	+.17
"	+.63
"	+.03
"	+.21
Gr. 2164. $\alpha = 14^h\ 48^m$ $\delta = +59°.8$	
	s.
1871	+.01
"	+.18
"	−.06
"	+.08
"	+ 04
"	+.02
"	+.05
"	+.06
"	−.06
1872	+.02
"	+.03
"	−.03
"	+.04
1873	+.05
"	−.03
"	−.06
"	−.01
"	−.06
"	−.11
"	−.10
"	−.12
"	−.28
1876	+.02

θ Draconis.
$\alpha = 16^h\ 0^m$
$\delta = +58^\circ.9$

Year of Obs.	H. C. O. *minus* Pub. XIV.
	s.
1871	−.20
"	−.14
"	−.08
"	−.08
"	−.07
"	−.19
"	−.12
1872	−.07
"	−.06
"	−.09
"	−.10
"	−.04
"	−.11
1873	−.12
"	−.09
"	−.04
"	−.10
"	−.07
"	−.13
"	−.21
1874	+.08
"	−.11
"	−.01
"	+.00
"	+.08
"	−.01
"	+.00
"	+.00
"	+.02
"	−.18
"	+.03
1875	−.08
"	+.27
"	−.18
"	−.12
"	−.04
187	−.10
"	−.35
"	−.04
"	−.28
"	−.14
"	−.07

η Draconis.
$\alpha = 16^h\ 22^m$
$\delta = +61^\circ.8$

Year of Obs.	H. C. O. *minus* Pub. XIV.
	s.
1871	+.03
"	−.21
"	−.17
1872	−.17
"	−.18
"	−.12
"	−.20
"	−.15
"	−.20
"	−.16
"	−.09
1873	+.12
"	−.13
"	−.14
"	−.15
"	−.08
"	−.39
1874	−.13
"	−.32
"	−.11
"	−.13
"	−.13
"	−.11
"	−.14
"	−.16
"	− 10
"	−.07
"	−.09
"	−.24
"	−.18
"	−.05
"	−.08
"	−.29
"	−.08
"	−.02
1875	−.08
"	−.18
"	−.16
"	−.19
"	−.19
"	−.24
"	−.25
"	−.02
	s.
1875	−.16
"	−.13
"	−.15
1876	−.28
"	−.16
"	−.24
"	−.40
"	−.13
1877	−.24
"	−.28
"	−.05
"	−.30
"	−.36
1878	−.10
"	−.17
"	−.08
"	−.34
"	−.23
"	−.25
"	−.03
"	−.21

Gr. 2377.
$\alpha = 16^h\ 43^m$
$\delta = +57^\circ.0$

Year of Obs.	H. C. O. *minus* Pub. XIV.
	s.
1871	+.09
"	−.11
"	−.10
"	−.08
"	−.12
"	−.13
1872	−.12
"	−.08
"	−.08
"	−.17
"	−.11
"	−.07
"	−.20
"	−.10
"	−.06
1873	−.16
"	−.25
"	−.06
"	−.03
"	−.08
"	−.20
	s.
1874	+.04
"	+.02
"	+.05
"	−.11
"	−.09
"	−.10
"	−.07
"	−.15
"	+.04
"	−.13
1875	−.10
"	−.12
"	−.10
"	−.06
"	−.17
"	−.15
"	−.13
1876	+.03
"	−.15
"	−.13
"	−.18
"	−.17
"	−.12

Gr. 2900.
$\alpha = 19^h\ 29^m$
$\delta = +79^\circ.4$

Year of Obs.	H. C. O. *minus* Pub. XIV.
	s.
1871	+.34
1872	+.20
"	+.07
"	+.07
1873 U.C.	+.11
"	+.02
"	+.16
"	−.04
"	+.04
"	+.17
"	−.02
"	+.24
"	+.15
"	+.37
"	+.09
1874	+.12
"	+.34
"	+.38
"	+.20
"	+.11

Collecting the results for each year we have:—

Br. 6.

Year.	Δa	No. obs.
	s.	
1871	+.062	4
1872	+.030	4
1873	+.156	8
1874	+.166	5
1875	+.400	2
1876	+.065	4
1877	+.274	8

η Cassiop.

	s.	
1870	+.007	3
1871	+.062	6
1872	+.087	3
1873	+.140	5
1874	+.059	8
1876	+.070	4
1877	+.087	7

36 Camelop.

	s.	
1871	+.073	3
1874	+.038	2
1876	+.080	4

1 H. Draconis.

Year.	Δa	No. obs.
	s.	
1871	+.106	14
1872	+.143	9
1873	+.242	7
1874	+.375	4
1875	+.297	7
1876	+.207	3
1877	+.234	5
1878	+.232	5

Gr. 6124.

	s.	
1871	+.036	9
1872	+.015	4
1873	−.080	9
1876	+.020	1

θ Draconis.

	s.	
1871	−.126	7
1872	−.078	6
1873	−.109	7
1874	−.009	11
1875	−.030	5
1876	−.163	6

η Draconis.

Year.	Δa	No. obs.
	s.	
1871	−.117	3
1872	−.155	8
1873	−.128	6
1874	−.135	18
1875	−.159	11
1876	−.242	5
1877	−.246	5
1878	−.176	8

Gr. 2377.

	s.	
1871	−.075	6
1872	−.110	9
1873	−.130	6
1874	−.050	10
1875	−.083	7
1876	−.119	6

Gr. 2900.

	s.	
1871	+.340	1
1872	+.113	3
1873	+.117	11
1874	+.230	5

Finally we have the following values for H. C. O. *minus* Pub. XIV. The residuals taken from the Memoir quoted, are also given. It will be remembered that they were derived from the observations of 1871, 1872, 1874 and 1875, by applying the systematic corrections given in Tables I., II., and III.

Star.	Δa from Observations between 1870 and 1873.	Δa from Memoir.	Diff.
	s.	s.	s.
Br. 6............	+.163	+.170	−.007
η Cassiop	+.077	+.090	−.013
36 Camelop........	+.067	+.100	−.033
1 H. Draconis....	+.204	+.192	+.012
Gr. 2164...........	−.014	+.087	−.101
θ Draconis....	−.080	−.093	+.013
η Draconis.........	−.164	−.141	−.023
Gr. 2377...........	−.097	−.093	−.004
Gr. 2900...........	+.156	+.156	+.000

NEW PROOF FOR DIFFERENTALS.

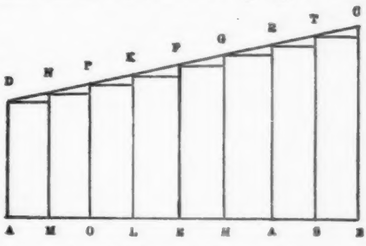
PROFESSOR JOSEPH FICKLIN, UNIVERSITY OF MISSOURI.

Problem—To find the differental of a variable quantity without the use of infinitesimals or limits.

I. If any function increases at a uniformely accelerated rate, the increment of that function in one unit of time is equal to the rate at which that function increases at the middle of that unit of time.

Dem.—1. It is evident that the increment of a function in one unit of time is equal to the mean, or average rate of increase of the function during that unit, whatever the law of increase may be. Thus, if a body moves 20 feet in one second, the mean rate of motion during that second is 20 feet, whether the motion be uniform, uniformly accelerated, uniformly retarded, or irregular

2. If a function increases at a uniformly accelerated rate; that is, if the increments in successive units of time are in arithmetical progression, the rate at which the function increases must receive equal increments in equal times. Hence, the successive rates are in arithmetical progression.



Let AB represent a unit of time, and suppose it to be divided into an even number of equal parts. Let AD andBC, parallel to each other, represent the rates of increase at the beginning and end, respectively, of the unit of time. Draw DC, and though the points of division on AB draw lines parallel to AD and terminating in AB and DC. Then, since the lines AD, MN, OP, &c. are in arithmetical progression, they will represent the rates of increase of the function at the corresponding instants of time. EF, which is equidistant from AD and BC, therefore represents the rate at the middle of the unit of time. Now, it is evident, from

the properties of the trapezoid, that EF is the mean between LK and HG equidistant from it. Therefore, in the case of uniformly accelerated increase, the rate at the middle of any unit of time is the mean rate during that unit. But the mean rate is equal to the increment of the function in a unit of time. (1). Therefore the rate at the middle of a unit of time is equal to the increment of the function in that unit of time. Q. E. D.

II. Let $u=x^2$, and suppose dx to be the rate at which x varies; then,

$u' - u = 2xdx + dx^2 =$ increment of u in first unit of time;
$u'' - u' = 2xdx + 3dx^2 =$ " " " second " " ;
$u''' - u'' = 2xdx + 5dx^2 =$ " " " third " " ;
$u'''' - u''' = 2xdx + 7dx^2 =$ " " " fourth " " ;
etc. etc. etc.

Hence, u increases faster each instant; and, since there is a constant difference ($2dx^2$) in the increments of u, the acceleration in the rate of increase of u is uniform.

Now, since the difference between u' and u is $2xdx+dx^2$, and, since u is increasing at a uniformly accelerated rate,

$$2xdx+dx^2$$

is not only the mean rate at which u increases during the first unit of time, but u increases at that rate at the middle of that unit of time (I).

But the rate at which u increases is increased by $2dx^2$ in one unit of time, for u is increasing at the rate of $2xdx+dx^2$ at the middle of the first unit, and at the rate of $2xdx+3dx^2$ at the middle of the second unit; hence, in half a unit of time, the rate is increased by dx^2. Therefore, if du represents the rate at which u increases at the instant $u=x^2$, then

$$du+dx^2$$

will be the rate at which u increases at the middle of the first unit of time.

$$\therefore \quad du+dx^2=2xdx+dx^2;$$

whence,

$$du=2xdx.$$

The same result may be obtained by equating the two expressions for the rate of which u increases at the middle of any other unit of time. Thus,

$$2xdx+5dx^2$$

is the rate at which u increases at the middle of the third

unit of time, and, since the rate at which u increases is increased by $2dx^2$ in one unit,

$$du+2\tfrac{1}{2}\times 2dx^2$$

is also an expression for that rate;

$$\therefore \quad du+2\tfrac{1}{2}\times 2dx^2=2xdx+5dx^2;$$

whence, $$du=2xdx.$$

III. Let $u=xy$; then

$$\begin{aligned} u'-u &= (x+dx)(y+dy)-xy=xdy+ydx+dxdy;\\ u''-u' &= xdy+ydx+3dxdy,\\ u'''-u'' &= xdy+ydx+5dxdy;\\ u''''-u''' &= xdy+ydx+7dxdy;\\ \text{etc.} \quad & \text{etc.} \quad \text{etc.} \end{aligned}$$

In this case the constant difference in the increments of u is $2dxdy$; and it may be shown, by a process of reasoning entirely similar to that used in II, that

$$xdy+ydx+dxdy$$

is the rate at which u increases at the middle of the first unit of time, and that

$$du+dxdy$$

is also an expression for that rate;

$$\therefore \quad du+dxdy=xdy+ydv+dxdy;$$

whence $$du=xdx+ydx.$$

If we put $y=x^2$, we have

$$du=d(xy)=d(x^3)=xd(x^2)+x^2dx.$$

But it has just been shown that $d(x^2)=2xdx$;

$$\therefore \quad du=d(x^3)=x\times 2xdx+x^2dx=2x^2dx+x^2dx=3x^2dx.$$

In this way it may be shown that, if n be any positive interger,

$$du=d(x^n)=nx^{n-1}dx.$$

It may be shown, in the usual way, that this equation is true, whether n be positive or negative, intergal or fractional.

REPORTS OF OBSERVATORIES FOR 1882.

The *Vierbeljahrsschrift* of the German Astronomical Society for 1883 (2° part) contains a series of reports from various observatories, mostly European, of which we give the following abstract:

ATHENS.

The personnel of the observatory consists of the Director, Dr. Schmidt, and an assistant, Dr. Wurlisch.

The *Sun* has been observed on 356 days for spots.

The chart of the *Moon* published in 1875 gave the results

of observations for the years 1840-1874. The measures are still continued, and with greater assiduity as may be judged from the fact that more measures have been made since the publication of the chart than were made for its construction.

Jupiter. 370 drawings of *Jupiter* made in the years 1841–1879 have been deposited in Potsdam. Since 1880, 350 drawings have been made. The other planets are often examined but seldom drawn.

Seventy-four *Variable Stars* have been observed, over 46,000 comparisons having been made. The *Zodiacal Light* and the *Twilight Arch* are observed at favorable opportunities.

BASLE.

This observatory is devoted chiefly to Meteorology and its results are published in the Swiss Reports of Meteorology, annually.

BERLIN.

The 9-inch equatorial has been remounted by Bamberg of Berlin.

The zone +20° to +25° is practically finished. The reductions are now in progress. The equatorial has been used by Dr. Knorre, for observatious of comets and asteroids.

The Berliner Jahrbuch, with its two series of circulars has been published as usual.

BONN.

The zone +40° to +50° is still in progress, 1,020 observations of zone stars having been made. The observer, Dr. Deichmuller took part in the transit of Venus expedition to Hartford, Conn. The reductions are well up to the observations.

The Southern Durchmusrerung now counts 357,490 star positions.

The *final* positions of 78,317 stars are now prepared for printing. It should be noted that *all* the work of the Southern Durchmusrerung is done by Dr. Schonfeld.

BRESLAU.

The report for 1882 differs from that of 1881 in no important particular.

DRESDEN.

[Private observatory of Baron v. Engelhart.]

Thirty-five observations of three comets and 110 observations of thirty-seven planets have been made and published, and some important changes have been made in the instruments.

DUSSELDORFF.

In 1882 fifty-seven observations of eighteen asteroids were made and since 1847 1,102 observations of 141 planets.

HAMBURG.

The zone $+80°$ to $+81°$ has been completed and the Observatory has begun the zone between $-15°$ and $-16°$.

The divided circle of the Meridian Circle has been replaced by a new one, made by the Repsolds.

HERENY, (Hungary.)

In 1882 the spectra of 147 fixed stars and two comets were observed, besides miscellaneous observations.

The stellar spectrum observations are classified in a table giving the types to which the stars belong.

KALOCSA, (Hungary.)

Regular drawings of the *Sun*, (22 c. m. in diameter) have been made during the year, and also a determination of the latitude and the (telegraphic) longitude from Vienna.

KARLSRUHE.

The instruments have been removed from Mannheim to a provisional observatory in Karlsruhe. With the 6-inch equatorial a series of measures of star clusters is kept up. The Reichenbach circle (made in 1811) has received thorough repairs and is employed in a determination of the places of stars south of the equator. The objective is only three inches and the stars selected are therefore 8 mag. or brighter. Each star is to be observed six times, and Dr. Valentiner hopes to determine the places to $0^s.01$ and $0''.15$.

KIEL.

The equatorial has received a thorough repairing by the

Repsolds, and has been used by Dr. Lamp in a series of *Victoria* and *Sappho* observations for Dr. Gill.

Dr. Krueger gives in a paragraph some criticisms of the programme prepared by Dr. Gill which deserve attention. Dr. Pape's observations for the determination of the equinox 1860, are printed. The printing of the zone +55° to +65° has been begun. Kiel will be in the future the central office for international scientific telegrams.

LEIPZIG.

The buildings and instruments have received a thorough revision, in particular the Meridian Circle and the electric system. Small planets and comets have been observed on the equatorial, and since July 1882, the sun-spot observations have been continued.

The first part of the publications of the observatory is prepared for publication.

LEIPZIG.

[Dr. Engelmann's private observatory.]

The principal instrument is an 8-inch refractor by Alvan Clark, which has been used for the measures of difficult double-stars.

MILAN.

The 8-inch refractor has been used in observing double-stars of which 426 measures have been made.

The topography of *Saturn*, *Mars* and *Mercury* has been studied, and Prof. Schiaparelli says that the spots on *Mercury* are not so difficult to recognize as is generally supposed.

The Meridian Circle has made 1,600 observations on the doubles discovered by Mr. Burnham. This work will be soon completed.

The observations of Dembowski are not yet ready for publication. The 18-inch refractor is in the hands of the Repsolds for mounting, and will not be ready for work before the end of 1884.

MOSCOW.

The work of this observatory is given in Vol. IX, part I, of its Annals which is just published.

MUNICH.

Besides smallar instruments the observatory has a Merz Refractor of 10½ inches, and a Meridian Circle of 4¼ inches aperture.

The buildings are being re-built and these instruments will be remodeled.

The Meridian Circle is in the hands of Ertel for this purpose. The hourly magnetic and meteorological abservations are discontinued, but will probably be resumed elsewhere. A series at longer intervals is kept up to connect the new series with the old. The Munich zones are being re-reduced. Dr. Seeliger is now director of the observatory.

NAPLES.

A list of the publications of the observatory and its observers is given.

O'GYALLA, (Hungary.)

Besides miscellaneous observations 618 micrometric measures of 182 sun-spots on 151 days have been made.

PADUA.

The longitudes Rome–Padua, Rome–Florence, Padua–Florence were telegraphically determined.

The 7-inch equatorial of Dembowski has been acquired by the observatory and will replace the 4-inch equatorial made by Stark.

PALERMO.

The sun-spots were drawn (scale of 0.51 m. to the solar diameter) on 315 days. The chromosphere and protuberances were drawn on 156 days.

Observations of the reversal of the Fraudnhofer lines, specially of 1474 K and b on 124 days.

Drawings of *Jupiter* on twenty-four days.

Observations of three comets on seventy-eight days.

Observations of twenty-two minor planets, and of comets.

A list of the publications of the observatory is given.

POTSDAM.

A spectroscopic examination of the stars from −1° to +20° has been completed, and the results are nearly ready for printing. It will contain 4,051 numbers.

Two hundred and fifty groups of sun-spots have been observed.

The observations of Secchi on the amounts of Heat given

out by different parts of the *Sun's* limb from equator to pole, have been repeated by Dr. Spoerer, who however finds no such difference as was reported by Secchi.

Photographs of the *Sun* have been made on 195 days.

The photometric observations (Tollner's photometer) will shortly be published in three Parts. Part I, will contain a description of the instrument and an investigation of the extinction of light. Part II, will contain the observations of planets, and part III, the observations of variable stars.

The comet Wells was photometrically observed on twenty-one nights. The result of these showed the comet to shine partly by its own light.

Variable stars have also been repeatedly observed.

PRAGUE.

Prof. Safarik gives an account of his observations of the *Moon*, *Venus*, *Mars* and comets, and of 677 observations of Variable stars, besides miscellaneous observations which cannot be summarized here.

STOCKHOLM.

Dr. Gylden has devoted his time to the continuation of his theoretical work on the motions of the major planets. The numerical computations require much time, and it is probable that the Reichstag will furnish computers to aid in the work.

The observations on stellar parallax are not fully reduced but appear to lead to the conclusion that the mean parallax of the first magnitude stars is rather less than 0″.1.

Victoria and *Sappho* were observed in conjunction with Dr. Gill.

UPSALA.

Victoria and *Sappho* were observed with the refractor for the solar parallax.

The observatory is undergoing repairs.

ZURICH.

The results of the observations of sun-spots are given in No. 59 of the Mittheilmegen, and the contents of that publication are summarized. Besides this, the miscellaneous observations of the observatory are given.

HABITABILITY OF THE PLANETS.

PROFESSOR R. W. MCFARLAND.

Thirty years ago the question of the habitability of the planets was widely, and, in some instances, intemperately discussed. Several volumes were written *pro* and *con*, the writers mostly seeming to think that they had a direct commission from on high to settle the question, or to settle their opponents; which things they proceeded then and there to do. And both sides about equally forgot or disregarded the facts, and, with great heat, argued on general principles.

An article in the June number of the *Popular Science Monthly*, entitled "The Cost of Life," and which was in part criticised in a late number of the MESSENGER, is a kind of renewal of the useless debate, and is clothed in logic equally conclusive as was that of the original controversy. The points given lately touching the weight of a man on *Jupiter* and on *Mars*, were intended as a part of the proof that those planets are not habitable. To pass in review all the points of error would require an article of too great length for the pages of this journal; so I shall confine myself pretty closely to a few of the more prominent ones.

The same author, speaking of *Mercury*, says: "With a temperature of boiling water in the frigid zones, and red-hot iron at the equator," &c.,—therefore there can be no life on the planet. But there is no proof of any such temperature, and in the nature of the case, there can be none. Wherefore the conclusions are of no force. The error consists in virtually assuming that the climate of a place depends solely on its distance from the *Sun*—whereas this is only one of a hundred causes.

It is well known that even in the torrid zone, at an elevation of about three and one-half miles, snow does not melt; that century after century "eternal" snows whiten lofty peaks in all latitudes.

The temperature of a place on the Earth's surface depends on many influences, any one or several of which

may be greatly modified or annulled by the others; so that there is no general rule for climate.

As a part of the multitude of things to be taken into consideration, as touching the matter in hand, we may name these, viz: The latitude, the elevation above the sea-level, the ocean currents, the direction of the prevailing winds, the presence and trend of mountain ranges, the amount of vapor usual in the atmosphere, the degree of cloudiness, the quantity of rain an snow-fall, the size of the body of land, the amount of land in close proximity and its surroundings, the nature of the soil, the amount and kind of vegetation, the density and height of the atmosphere, the length of the day, the obliquity of the *Sun's* rays, and the thousand and one other things which go to make up the whole temperature and climate. Of the greater part of these,—indeed, of almost every one of them,—as exhibited on other planets, it is absolutely impossible to know anything at all; and, as a matter of course, no one can speak intelligently of the climate on any planet, except our own. But should all these items be known, the further question arises whether it is not possible that animated beings could live in an environment totally unlike that which surrounds us. The conclusion of the whole matter so far as astronomy and physics can now tell, is this, that the four large outer planets have not sufficiently cooled down to allow life on their surface, such as we see on the earth; that *Mars* gives all telescopic and spectroscopic probabilities of conditions compatible with life as we see it; that the earth certainly for millions of years has been covered with multifarious life; that of *Venus* and *Mercury* we have no certain knowledge; and that the satellites are pretty certainly not fitted for such life as is on the earth; that, in particular, our *Moon* has no water and no atmosphere, consequently no climate or vegetable life. If the *Sun* and the planets continually lose heat, then there will come a time in the far future when the *Sun* itself shall go out in everlasting night, and the planets cool down so that the "eternal snow" would be hot compared with the degree of cold throughout all space where everything shall be dead.

Ohio State University, Columbus, O., Sept. 20, 1883.

LIST OF ERRATA IN COFFIN'S REFRACTION TABLES. WASHINGTON ASTRONOMICAL OBSERVATIONS, 1845.

WILLIAM C. WINLOCK.

The following list of errata in the Refraction tables published in the Appendix to the Washington Astronomical Observations for 1845, has been compiled from a number of copies of the tables which have been in use for twenty-five years or more; but many of the errata have, I believe, been discovered by Mr. W. M. Brown of the U. S. Naval Observatory.

"Page" refers to the page as numbered in the volume of of 1845.

Page 61 first col. near bottom for 67′ read 57′

61	log R	9°	60′,	for	0.35484	read	0.95484
62	"	18	6 ,	"	4.22283	"	1.22283
64	"	34	56 ,	"	6.55243	"	1.55243
66	"	61	14 ,	"	1.06705	"	1.96705
67	"	68	6 ,	"	1.10076	"	2.10076
68	"	75	22 ,	"	2.28550	"	2.28350
68	"	73	47 ,	"	2.33821	"	2.23821
68	"	74	56 ,	"	1.27072	"	2.27072
68	"	77	43 ,	"	2.37903	"	2.35903
70	"	79	10 ,	"	2.44195	"	2.41195
70	"	80	4 ,	"	2.44885	"	2.44785
71	log T	+51°		"	918	"	928
	"	"		"	910	"	920
	"	"		"	901	"	911
	"	"		"	803	"	903
	"	"		"	884	"	894
	"	"		"	876	"	886
71	log B	$30.^{m}64$		"	590	"	390

U. S. Naval Observatory, Sept. 10, 1883.

EDITORIAL NOTES.

A very faint telescopic comet was discovered September 1st by Prof. William R. Brooks, Phelps, N. Y. It has the appearance of a nebulous mass, a little brighter at the center and with indefinite outlines. It is now about three hundred millions of miles from the *Earth* and about the same distance from the *Sun*, and is slowly approaching both. The discovery is a remarkable one in view of its great distance and faintness when first seen. We are not aware that the history of astronomy furnishes a parallel in these particulars. If computation at hand may be trusted, the comet will not reach the perhelion of its orbit before May, 1884, at which time its brightness will be about one hundred times as great as it now is.

By a *Science Observer* circular we are favored with the following elements and ephemeris:

ELEMENTS.

	HARVARD.	PALISA.	BOSS.	
T=1884.	March 15.70	February 3.45	June 2.6736	Gr. M T.
	° ′	° ′	° ′ ″	
π=	121 53	98 56	151 1 52	Mean Eq. 1883.0
☊=	278 18	258 18	311 44 55	
i=	82 2	76 13	89 20 56	
q=	.7537	.7446	1.04174	

The following observations, taken at Harvard College Observatory by Messrs. Wendell, Searle and Chandler, and two received from Prof. H. C. Wilson, in charge of the Cincinnati Observatory, at Mt. Lookout, Ohio, are given for the convenience of computors.

Date.	Local M. T.		App. α	App. δ	Observer.
1883.	d. h. m. s.		h. m. s.	° ′ ″	
Sept.	3. 11 25 4	Harvard.	16 35 15.60	+64 49 33.2	Wendell.
	4. 11 19 19	Harvard.	16 34 11.88	64 37 24.0	Chandler.
	4. 11 25 49	Harvard.	16 34 9.58	64 37 18.0	Wendell.
	4. 13 29 25	Harvard.	16 34 4.32	64 36 12 2	Wendell.
	5. 8 10 3	Harvard.	16 33 17.65	64 26 33.2	Wendell.
	5. 10 12 18	Mt. Lookout.	16 33 12.48	64 24 56.6	Wilson.
	6. 8 22 16	Harvard.	16 32 19.48	64 13 58.2	Wendell.
	6. 9 42 3	Harvard.	16 32 18.69	64 13 29.1	Chandler.
	6. 9 30 10	Mt. Lookout.	16 32 16.79	64 12 55.3	Wilson.
	6. 15 43 43	Harvard.	16 32 2.95	64 10 7.4	Wendell.
	7. 8 12 27	Harvard.	16 31 24.80	64 1 20.5	Wendell.
	9. 9 16 48	Harvard.	16 29 48.88	+63 35 43.4	Searle.

Professor H. C. Wilson of Cincinnati Observatory computed a preliminary orbit from the observation of Harvard College Observatory

Sept. 3, and his own made at Cincinnati Sept. 6 and Sept. 10. The elements obtained were as follows.

$$T = \text{May } 15.61 \text{ 1884 Greenwich M. T.}$$

$$\left.\begin{array}{l} \pi = 148^\circ \ 51.'1 \\ \Omega = 305 \ \ 35.3 \\ i = \ \ 88 \ \ 13.5 \end{array}\right\} \text{Mean Eq. 1883.}$$

$$q = 0.9032.$$

These elements satisfy the middle observation very closely.

$$d\lambda \cos \beta = 0.'0 \qquad d\beta = -\ 0.'2$$

The arc through which the comet has moved since first observed is yet so short that it is impossible to get a very accurate orbit. From the above elements Professor WILSON computed a rough ephemeris, at intervals of thirty days which will serve to indicate its path to perihelion. It is as follows:

			α h	m	s	δ °	′	Δ	r	Light
1883	Sept.	17.5	16	25	10	+62	0	3.63	3.57	1.12.
"	Oct.	17.5	16	39	13	+56	23	3.31	3.23	1.68
"	Nov.	16.5	16	50	30	+51	47	2.99	2.86	2.62
"	Dec.	16.5	17	31	19	+50	45	2.59	2.51	4.55
1884	Jan.	15.5	18	30	58	+54	48	2.12	2.14	9.36
"	Feb.	14.5	20	28	8	+64	34	1.65	1.76	22.93
"	Mar.	16.5	2	28	48	+63	22	1.37	1.38	53.70
"	Apr.	15.5	4	45	29	+38	32	1.35	1.05	95.55
"	May.	15.61	5	48	0	+10	5	1.55	0.90	98.43

The observations made by Professor WILSON for position of the comet are as follows:

Mt. Lookout M.T.	h	m	s	app. α h	m	s	l.f.p. α	app. δ °	′	″	l.f.p. δ	star
Sept.	5	10	12	18	16	33	12.48	9.998	64	24	56.6	9.387	a
	6	9	30	10	16	32	16.79	9.962	64	12	55.3	9.806n	b
	10	14	27	24	16	28	55.96	9.820	63	19	16.1	0.855	c

Comparison Stars.

	α 1883.0 h	m	s	δ 1883.0 °	′	″	Reduction. s	″	
a	16	32	29.55	64	27	27.8	−0.14	+20.4	O. Arg. N. 16374
b	16	33	40. 90	64	10	22.9	−0. 14	+20.4	O. Arg. N. 16400
c	16	35	44.44	63	18	33. 2	−0. 15	+20.4	O. Arg. N. 16415; Radcliffe 3592

Under date of September 21, Professor LEWIS BOSS, Director of Dudley Observatory, Albany N. Y., kindly sends the following:

COMET *b* 1883 (BROOKS).

By means of observations secured at the Dudley Observatory on

September 5th, 9th and 18th, I derived on the 19th the following parabolic elements marked I. The remarkable similarity of these elements to those given by Schulhof and Bossert for the Pons comet of 1812 pointed unmistakably to their identity. The elliptic elements of the Pons comet (here marked II) are transcribed from the memoir of Schulhof and Bossert (p. 150), except that they are reduced to the mean ecliptic and equinox of 1883.0, and a value of T derived from observations of the present apparition is substituted.

I.			II.
T=1884 January 25.788 (G. M. T.).			T=1884 January 25.699 (G. M. T.)
Node................	254°	13′.6	254° 8′.8
Node to Perihelion...	199	14.4	199 12.9
Inclination...........	74	47.1	74 03.3
log. q................		9.87944	log. q........9.88930
			Eccentricity, 0.95527

The value of T in II was determined by approximation from the observation of September 5th. The remaining observations do not indicate any important change in its value. The following ephemeris results from elements II. The geocentric positions are referred to the mean equinox of 1883.0.

Greenwich 12 hours.	α h	m	s	δ °	′	log. Δ	Light.
Oct. 4....	16	29	06	58	07.5	0.3009	.06
8............		31	57	57	16.5	0.2897	.07
12............		35	32	56	26.5	0.2779	.08
16............		39	52	55	37.6	0.2653	.08
20............		44	56	54	49.9	0.2518	.09
24............		50	47	54	03.3	0.2377	.10
28............		57	25	53	17.8	0.2226	.12
Nov. 1............	17	04	53	52	33.3	0.2065	.14
5............		13	15	51	49.6	0.1893	.16
9............		23	34	51	06.0	0.1708	.19
13		32	56	50	22.4	0.1512	.22
17............		44	26	49	37.0	0.1302	.26
21....		57	14	48	49.4	0.1077	.32
25............	18	11	27	47	57.1	0.0836	.38
29............		27	16	46	58.1	0.0580	.46
Dec. 3............		44	50	45	43.2	0.0300	.57

In the light scale, .19 corresponds to that of discovery in 1812, and 1.00 to the time when the comet was reported as visible to the naked eye in the apparition of 1812. The places of the above ephemeris sepresent the observations already made within abont 30″ in each coordinate, and with a very uniform minus value of "c–o" throughout. This seems to be the fault of the elliptic elements. Any considerable

change in the time of perihelion passage diminishes the discrepancy in one co-ordinate at the expense of the other.

It is remarkrble that the present comet should have been picked up when its light ratio was six times as small as it was at discovery in 1812. It was then regarded as a faint object. Were it not for the overwhelming testimony from other sources, one might doubt, on the ground of brightness, the identity between the present comet and that of 1812. The following rough ephemeris may be of interest:

1883.	α	δ		1884.	α	δ	
	h m	°	Light.		h m	°	Light
Dec. 3......	18 45	+45.7	.6	Feb. 1....	0 34	−28.3	2.3
13......	19 37	+41.7	1.0	11....	1 02	−37.2	1.5
23......	20 41	+33.9	1.8	21....	1 23	−43.7	1.0
1884.							
Jan. 2......	21 53	+22.1	3.5	March 2....	1 43	−48.5	.6
12......	23 01	+ 2.5	4.1	12....	2 02	−53.0	.4
22......	23 53	−15.2	3.0	22....	2 26	−56.2	.4

The identity of the Pons comet of 1812 with comet *b*, 1883, was announced in an "Associated press" dispatch from the Dudley Observatory on the evening of September 19.

The June number of the *L'Astronomie* (French) has an interesting article on the distribution of the asteroids in the zone peculiar to them. Following it is a full page cut illustrating the positions of the groups and the vacant spaces in the singular distribution of these small planets. The illustration is an excellent one, and does the writer, General PARMENTIER, credit. The main points of the article, however, were first published some time ago, by our own distinguished astronomer, Professor DANIEL KIRKWOOD, who is certainly the pioneer in this kind of work as will be seen by reference to the Monthly Notices R. A. S. Jan. 1879; and in the Smithsonian Report 1876. Doubtless General PARMENTIER has given due credit to Professor KIRKWOOD in some former article for important early work in this field. A late number of the *Observatory* (London) certainly has done so in the following language:

"Professor Kirkwood showed some twenty years ago that Jupiter exercised a peculiar influence over the minor planets, tending to produce well marked gaps amongst them at certain well-defined distances. For, if the period of any minor planet were commensurable with that of Jupiter, the latter would exercise a perturbing influence upon it, which would eventually result in a complete change of orbit. Later on, in 1868, Professor Kirkwood employed the same principle to account for the great division (Cassini's) in Saturn's rings. Maxwell had shown that the rings must be formed of separate particles moving round the planet to a certain extent as independent satellites. But a body moving round Saturn at the distance of Cassini's division would

have a period that was very closely commensurable with those of each of the six inner satellites, and it would, therefore, be especially exposed to pertubation. Dr. Meyer has carried the principle yet further, and has investigated every possible combination of the commensurbilities of the revolution periods of the satellites, and he finds that, including the division of Cassini, there are seven places where the satellites would unite to exercise a perturbing influence on the members of the ring system."

ACCURATE FOCUSING OF AN EYE-PIECE.

It is usually stated that an accurate focus is best obtained by employing a close and difficult double-star for the purpose. My experience is that a *cluster* composed of stars close together and of magnitudes which differ among themselves considerably, is a still more satisfactory test of a good focal adjustment. The eye is sensitive to the very least change in focusing on such an object: while there is a certain, though small, range which the eye will tolerate on a double-star, no matter how difficult. I should be glad to know if the experience of other observers agrees with my own. EDWARD S. HOLDEN.

ILLUMINATION OF THE FIELD OF VIEW IN THE DETERMINATION OF THE NADIR-POINT.

The general practice is, I believe, to employ a cap over the eye-piece which has a plane glass reflector above it. The image of a lamp flame is reflected into the field and on this image the position of the reflected wire is measured. The field is of various brilliancy in different parts, owing to the reflections from the two surfaces of the glass etc., and this is often annoying and always fatiguing to the eye. I have found that by interposing a screen of ground glass, or even one or two thicknesses of oiled silk, between the flame and the reflector, a uniformly illuminated field is obtained, and the improvement is so great that I think it worth while to mention it here.

EDWARD S. HOLDEN.

LACAILLE 8066. 7th MAGNITUDE.

In 1878 STONE looked for *Lacaille* 8066 and found no 7th magnitude star in place. It has been observed by YARNALL, and is now in place and 7th magnitude. STONE's note in the C.G.H. catalogue shows that he looked for the star 5′ too far south. (Precession applied with wrong sign.) E. S. H.

ZONE OBSERVATIONS AT THE OBSERVATORY OF SANTIAGO DE CHILE.

From 1855 to 1860 MAESTA observed zones between −40° 30′ and −46° making 10,200 observations. These were ready for printing in 1866. Other zone observations appear to have been made in 1861 and 1862. Both series were to be printed at the exp ense of the government, according to a note in the V. J. S. der Ast. Gesell. 1866 p. 22, but it is belved these never were printed. The ground is now completely covered by the catalogue of STONE (1880) and the zones of GOULD.

Investigation of the inequality of the pivots of the Fauth Transit of the Washburn Observatory, by Miss A. J. Sanborn, *student in Astronomy.*

Individual values of p.

First Series — Telescope pointing South.

Date. 1882.	p. d.	Date. 1882.	p. d.	Date 1882.	p. d.
Oct. 25.	+0.10	Nov. 1	−0.30	Nov. 8	−0.27
	−0.30	Nov. 2	−0.40		−0.19
	−0.33		−0.42	Nov. 9	−0.39
	−0.56		−0.12		−0.56
Oct. 31.	−0.30	Nov. 3	−0.27		−0.05
	−0.37		−0.31		−0.38
	−0.49		−0.22	Nov. 10	−0.38
	−0.56		−0.20		−0.25
	−0.34	Nov. 6	−0.22		−0.35
Nov. 1	−0.41		−0.11		−0.30
	−0.31		−0.10		
	−0.33		−0.25		
	−0.36	Nov. 8	−0.25		
	−0.24		−0.34		

Mean value of p = $-0^d.3008 \pm 0^d.0133$. Probable error of 1 determination = $\pm 0^d.0820$, p in time = $-0^s.0322 \pm 0^s.0014$.

Second Serries. — Telescope pointing North.

Date. 1882.	p. d.	Date. 1882.	p. d.
Nov. 13.	−0.11	Nov. 21.	−0.27
	−0.20		−0.07
Nov. 14.	−0.34		−0.19
	−0.35		−0.21
	−0.24	June 12, 1883.	−0.16
	−0.14		−0.34
Nov. 20.	−0.16		−0.34
	−0.36		−0.18
	−0.17		−0.35
	−0.20		−0.35
	−0.31		−0.28
Nov. 21.	−0.15		−0.37
	−0.17		

Mean value of p = $-0^d.2404 \pm 0^d.0140$. Probable error of determination = $\pm 0^d.0701$, p in time = $-0^s.0257 \pm 0^s.0015$.

Combining the results from both serries we find

$$p = -0^s.029 \pm 0.^s001$$

The linear difference in the radii of the pivots is 0.000053 of an inch, the clamp pivot being the larger.

E. E. BARNARD, Vanderbilt Observatory, Nashville, Tenn., Sept. 6, observed the Brooks' comet. It was faint in the 6-inch equatorial. On the 7th he saw it as an indefinite patch of light nearly two minutes in diameter with very slow motion to the south-west.

NEW NEBULAE.

Under date August 30, Mr. BARNARD announces a large faint nebula, very diffuse, in

A. R. 0^h 46^m 30^s ±.
Decl. +55° 58′ ±

Also, another new nebula, in

A. R. 17^h 5^m 52^s ±
Decl. −36° 56′ 52″ ±

He reports it as "small, flickering, indefinite. Professor SWIFT finds it to be a beautiful triple nebula." Its major axis is nearly perpendicular to the meridian. A smaller nebula lies at each end of the largest, one of which is exceedingly faint; possibly all are connected by a nebulous ligament.

Sept. 13. Mr. BARNARD writes, "Please announce the following new nebula: In

R. A. 3^h 9^m Decl. −26°

Faint, small, 30′ ± north of six or seventh magnitude star.

Also in

A. R. 23^h 7^m ± 30^s
Decl. −29° ±

Faint, moderate size, in field with, and 20′ *n. f.* General Catalogue No. 4900, close *n. f.* two stars

The places will be more accurately determined as soon as moonlight disappears.

Several observers of ihe BROOK'S cemet have noticed considerable increase in its brightness from the 20th of last month onward. Under date of Sept. 25, Professor BROOKS says that both the nebulosity and the nucleus had rapidly increased during the preceding three days, so that on the evening of last observation, the comet was an easy object in a small telescope. He is of the opinion that if the same rate of increase continues the comet must soon be visible to the naked eye.

Mr. MILES ROCK, assistant astronomer of the U. S. Naval Observatory has accepted an appointment as Chief Astronomer and Engineer Commissioner in the International Boundary Commission of Guatemala to locate the boundary between that country and Mexico. He will sail from New York, Oct. 1, to be absent about a year. W. U.

Professor H. M. PAUL, late of the Imperial University of Japan has returned to this country.

Our readers will quickly notice that a large part of the more valuable contributions in this issue, are from the ready pen of Professor HOLDEN, of Washburn Observatory. We also desire to say that Professor HOLDEN is in no way responsible for the typographical errors of the first two forms of this number. The proof, though sent him was lost in the mail. After holding type ten days, errors were corrected without copy. If contributors will give carefully clear copy, especially in the case of proper names. we will try to have all copy faithfully rendered. Proof is examined by three different readers.

Professor R. W. McFARLAND, Department of Astronomy, State University Columbus, Ohio, is also State Inspector of Railways and Railway bridges. In the midst of all his varied duties, he finds time to prepare interesting matter for the MESSENGER. His article, this month, is timely and pointed.

The enterprising firm, Messrs. Fauth & Co., Astronomical Works Washington, D. C., have removed their place of business to Nos. 132-134 Maryland Avenue, S. W. one block north and west of their former location, where they have erected a large establishment, fitted up expressly for the manufacture of astronomical and engineering instrumets. Their instruments are used by the best astronomers in this country.

Astronomers will be glad to know that Professor D. KIRKWOOD has now ready for the press as we are informed, a full treatise on the Minor Planets which will contain a statement of his theory of the irregular distribution of these bodies in space, and other information respecting their discovery, magnitudes, motions, etc.

Special attention is called to a new advertisement of a Clark Refractor found on the second page of the cover. This opportunity seems to be a very favorable one for the purchase of a desirable observing outfit.

THE STAR LACAILLE 8778.

This star has proper motions of about $-0^s.04$ and $-0''.4$. For 1850

Stone;	21^h	11^m	$3^s.45$,	$-26°$	$58'$	$12.''7$;	1878.7,	1878.7
Yarnall;			4 .07,			6. 9;	63.3,	65.8
Argelander;			4.69,			1. 0;	49.7,	49.7.
Lacaille;			8 .0,	−26	57	14 −;	1750.0	1750.0

E. S. H.

HENRY W. FAUST of San Francisco, has sent to the MESSENGER, during the last two months the largest list of new subscribers received from any one place. We tender him our most cordial thanks.

BOOK NOTICES.

Astronomy — Newcomb and Holden: Condensed edition: pp. 338 Henry Holt & Co., New York.

The condensed edition contains about seven-tenths of the matter of the original work. The severer portions of the mathematics have been excised, so that simply a fair acquaintance with algebra, geometry and rudimentary physics is necessary to study the book with profit. Prof. Holden has succeeded in rendering the work available for use in colleges where a fresh and trustworthy presentation of the subject of Popular Astronomy is desired. H. A. H.

Lehrbuch zur Bahnbestimmung der Kometen und Planeten, von Theodor R. v. Oppolzer. Erster Band: zweite und ganzlich neubearbeitete auflage. Wilhelm Englemann, Leipzig, 1882.

The improvements over the first edition are so varied and numerous that we have not space to recount them. Almost every topic has been explained with greater fullness than before, and the author has availed himself of new methods, whenever he considers them better. For instance, he explains his own method of computing planet-orbits very fully, and gives only a resume of Gauss' method; this is done because much experience has shown the former to be preferable. In the computation of the orbit of Ceres, Oppolzer's first hypothesis gives a result nearer the truth than Gauss' third, and Oppolzer's second hypothesis gives a sufficiently rigorous result.

In the special case which occurs in the comet orbits, when cos $(W_{,} - W_{0}) < \frac{1}{2}$ the method of computation has been simplified. The author seeks the best methods even in small matters, and hence gives Tetjen's check-formulas used in the transformation from right ascension and declination to longitude and latitude; in the solution of Kepler's Problem Herz's method is given, which is very advantageous for planetary orbits.

The subject of precession and nutation has been amplified from twenty to one hundred and fifty pages; the explanation is detailed and the results are the same as those already given by the author in A. N. 2387. The computation of these is lightened by a collection of tables. There is a new set of tables for the computation of the true anomaly in orbits nearly parabolic; and computors will be glad to learn that for parabolic orbits Barker's Table has been re-computed, the argument v being given for every 10″ from 0° to 176°, and proportional parts being added.

Special care has been taken to avoid typographical errors.

On the whole it may be said that this volume should be in the hands of every astronomer, who is interested in orbit-work; the new edition steps easily into the first rank, no other book on the same subject being comparable with it. H. A. H.